PIGEON PLEX

# Penguin+

User Manual

## Revision Control

| Version | Description | Name | Date |
|---|---|---|---|
| 1.0 | Initial Document for Penguin+ | Randolph Bock | 30 November 2023 |
| | | | |
| | | | |

## Document Referenced

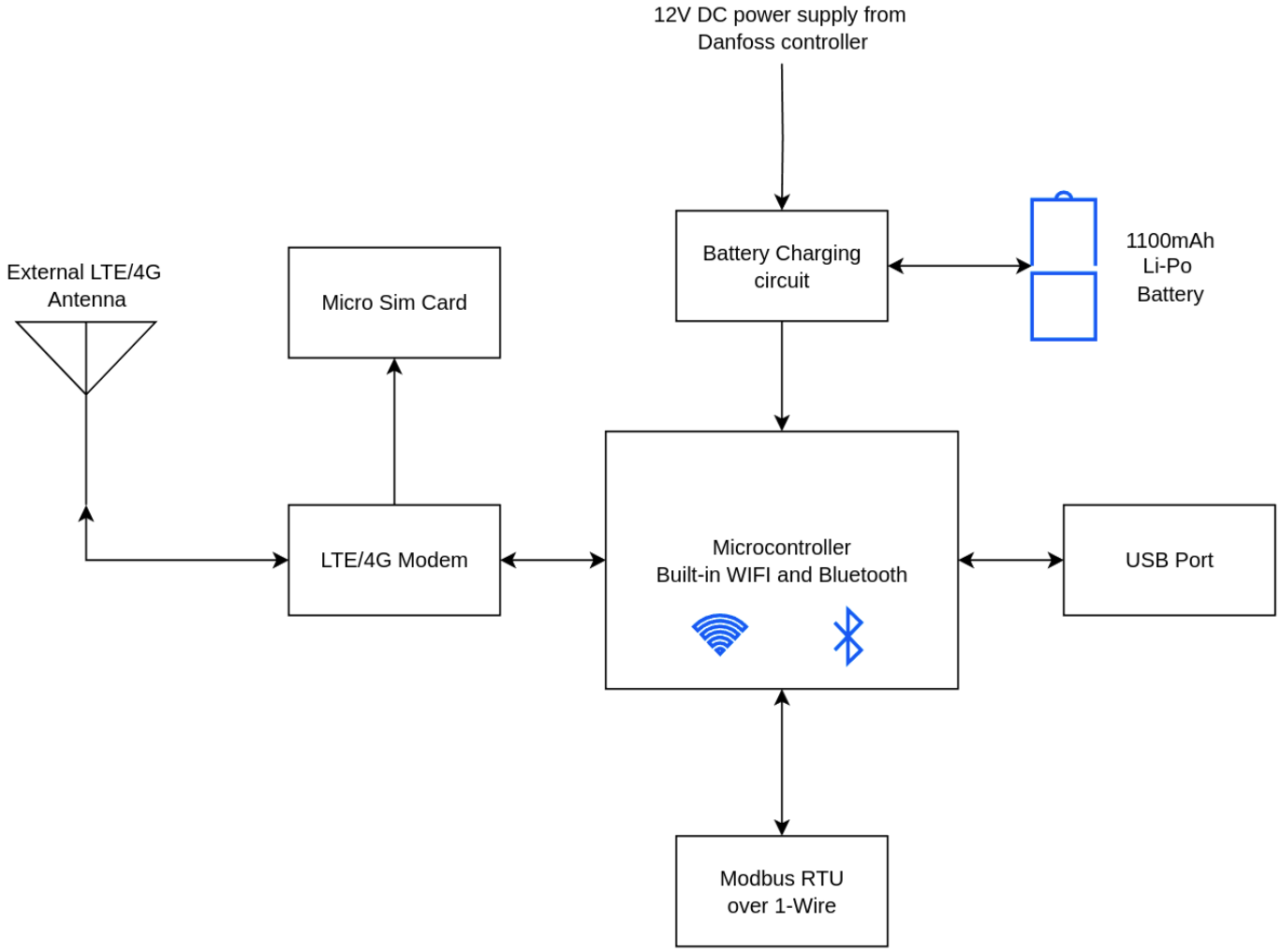
- API A Datasheet – API Specification
- UserManual-Console1 – User manual for console Revision 1

## Index

# Hardware

## Block Diagram

Penguin+ hardware block diagram.




## Bluetooth

Bluetooth is part of the microcontroller, which also contains the internal Bluetooth antenna. For the current firmware, the Bluetooth has been configured as a BLE server following the SIG standard. The purpose of the Bluetooth is to access configurations of the Penguin+. To configure the device via BLE please refer to the Digital Twin Aviary V1.0 Manual.

## Wi-Fi

The Wi-Fi is part of the microcontroller, which also contains an internal antenna. For the current firmware, the Wi-Fi is configurable to 4 different modes. The API calls to set the Wi-Fi modes are all documented in API A Datasheet. Manual will contain examples illustrating the different use cases of the all the available Wi-Fi modes.

## LTE/4G

LTE/4G is brought out to a PCB UFL connector. Either an internal or external antenna can be ordered as specified by the part number. If external, a UFL to SMA adaptor is fitted and brought out through the enclosure. Note, that this is not a refit option and cannot be changed.

## SIM

A micro SIM is enclosed in the unit, on the rare occasion the SIM card needs to be changed and the enclosure needs to be opened.

## Non-Volatile Memory

A 4K bit NVRAM (500 Bytes) is available for storage of variables such as pulse totalizer. The 4Mbit NVRAM (500kBytes) is for configuration data.

## Power Supply

The power supply is 12V 200mA DC that is supplied to the Penguin+ from the Danfoss controller.

**NOTE** that the power supply for the Danfoss controller is non-isolated. Please make sure to disconnect the device from power when servicing the device, or before connecting to the device via the USB connection.

## RS485 over 1-Wire

The Penguin+ implements RS485 over a 1-Wire connection with level shifting enable. No internal biasing or terminating resistors are present on the Penguin+. The firmware determines which protocol is enabled and the API determines the register mapping. Communications parameters are set at commissioning stage. Check the specification sheet for which birds have RS485 ports.

## USB

A USB type C (USB2.0) port is fitted to the Penguin+ to connect a PC terminal program for direct API commands. The USB Port allows for connection to a PC terminal program for direct API commands.

## Overview of Communications

Standard method of communication:

The birds transmit JSON strings to a user defined MQTT broker client through a data connection over a LTE/4G connection. The Penguin+ publishes information to the “data” topic and subscribes to the “commands” topic. The birds are differentiated by their ICCIDs on the MQTT broker, I.e. *ICCID/data* (*A4E57C764FA0/data*) or *ICCID/commands* (*A4E57C764FA0/commands*).

# Configuring the Bird

## Tools Required

To configure and test, the following tools are required:

1. Penguin+ hardware.
2. USB to USB type C cable.
3. API datasheet

Birds require configuration before sending useful data. Do not assume that the default configuration will work for the installation without first checking on the data sheet.

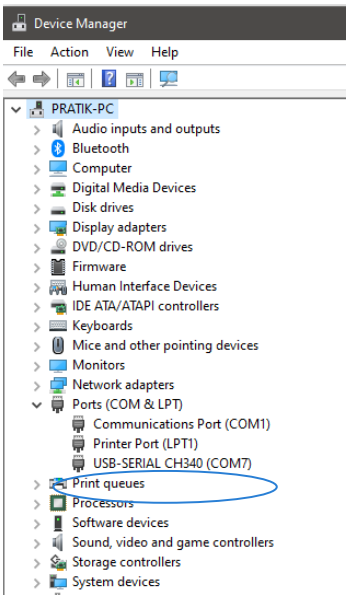
Birds are configured using console or direct connect USB (terminal). In both instances the commands defined in the API are sent to Bird. For USB configuration follow the steps below under USB Configuration.

There are a few methods of configuration from the console – this section shows console manual configuration method where commands are typed in, same as for the USB method. Skip to Console Configuration Manual if you are configuring from the console.

## USB Configuration

Plug USB to USB type C cable from PC to Bird.

Open a terminal program such as Tera Term or Hercules. Select the correct serial port and set the baud rate to 115200. If you are not sure of the serial port number, open Windows Device Manager – look for Ports (COM&LPT). Expand the option and the serial port number will show.




In the example on the right there is only 1 com port – COM7. If there are more than 1 serial device, you can unplug the bird USB and note which serial port disappears from the list. Plug Bird in and the serial port for Bird will show.

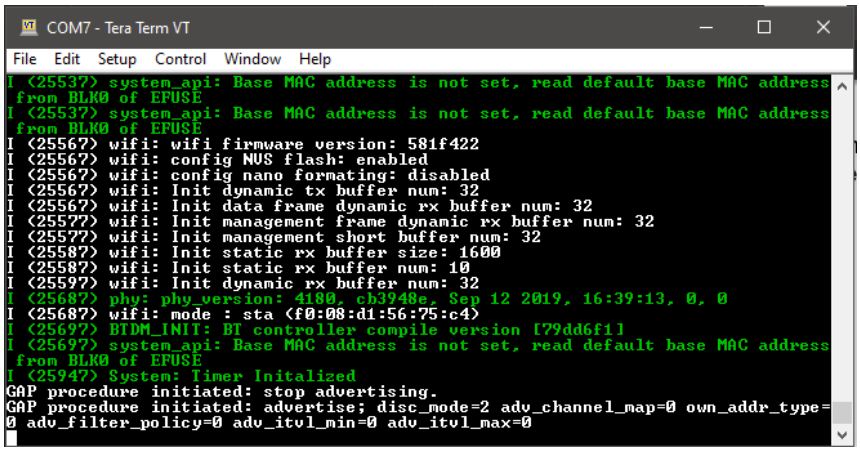
Tera Term (Recommended serial application)

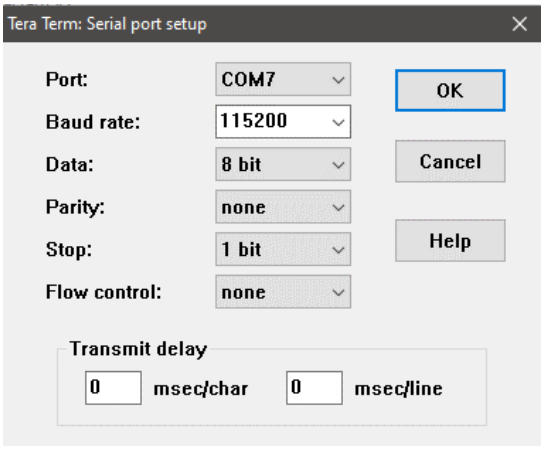
Click Setup -> Serial port … to change the com port and baud rate.

The image on the right shows the serial port setup for COM7.

Set the Port: to the desire port (in this example COM7)

Set the Baud rate: to 115200

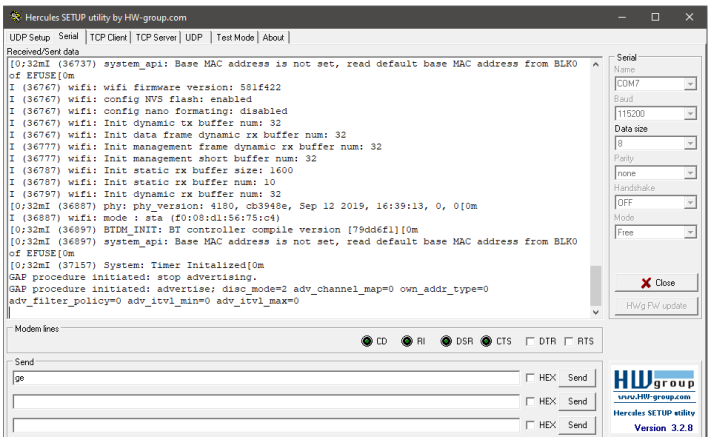


Hercules is another serial port tool – which is an option because there are Send windows to allowing stacking of up to 3 commands to facilitate faster pasting of commands from Configure-a-Bird tool.

Select the Serial parameters as shown and click on Open (the same button that shows Close on the image). The button text changes depending on the state of the serial port.

Once the serial port is setup – return to the terminal window and press Enter. If all is connected and the serial port setup correctly, a log message will display each time Enter is pressed. This indicates a successful connection and user can proceed with sending commands to the bird using the API command structure.




Recommend - Skip to Sending the _command to send a command from the terminal window you can then circle back and read the console configuration and do the same exercise from the console.

# Configuring tricks and tips

## Notes on messages

During terminal configuration, Bird may be receiving/sending commands/messages from both the console and USB terminal – this sometimes leads to conflicting messages which could be interpreted as incorrect results.

If a command is sent from the console and not immediately acknowledged with the correct response, check that Bird is not already connected to the console.

## Reboot

If the Network and Coms Status lights remain off for a period of a few seconds or longer after sending configuration commands – especially with reboot:1, then wait 5-8 minutes for the modem to re-connect. The connection process for the bird has several steps such as initialising modem, establishing connectivity to the broker, requesting cell tower location information etc.

A reboot:1 command firstly sends all queued messages before reboot – then reboots. After establishing connection, device messages are sent to the console. Device, Location, Modbus-values. Use the console (*remember to reconnect after a reboot*) and wait for the “modbus-set” message payload to complete to indicate Bird is ready for commands.

## Viewing Logs

TeraTerm is the best program to use because it automatically reconnects on Bird reboot. The logs are then available from restart. These can be copied and sent to support@digitaltwin.digital for assistance.

## Printing file returns no result

If a pf:<file name> is sent and the command does not return the contents of the file as expected, try resend the command. If the results are still blank – then the file has been deleted. Resend the file contents nf:file name>

## Sending commands

Practical session - configuring a Bird.

Note: communications are excluded from the first set of exercises as each protocol is different and is dealt with in its own section. Refer to API A datasheet, messages section to understand the message types (Configuration/Period/Get) and Groups (General/Input/Output/Location/Condition/Communications)

### Configuration, Period Get and Set

Messages are solicited and will result in a solicited ACK or payload as defined in the API payload section. The messages are used to determine how Bird operates and is typical for the Penguin+ using Firmware Rev xxxx.

## Communications – RS485 over 1-Wire

Communications consists of 3 parts

- Hardware (RS485)
- Firmware
- Licence
- Configuration

### Hardware

The Penguin+ allows for RS485 communication over a 1-wire connection.

### Firmware

The protocol (language) supported by Penguin+ is determined by Firmware and licenced options. The firmware currently supports Modbus RTU server.

### Configuration

Each protocol requires configuration to map the variables required into a table in Bird. The mapping procedure is different for each protocol and can in some cases require a technical understanding of the protocol to bits and bytes level. Digital Twin provide an hourly configuration service - speak to support@digitaltwin.digital to prepare your application.

## Communications – Modbus

### Introduction

Bird functions as a Modbus Server and communicates to addressed slave field devices. The only device on the bus that can operate as a master is the Bird. Modbus registers as detailed in the configuration are polled and interpreted sequentially then reported back to the console.

The explanations going forward requires a working knowledge of the protocol. https://en.wikipedia.org/wiki/Modbus is a great resource to get a better understanding. If you do not know the Modbus register types and addressing scheme, then start there.

Please review the API-A datasheet - Configuration File Commands section.

### Communications Parameters

Modbus RTU requires the following RS485 parameters.

- Baud Rate
- Data Bits
- Stop Bits
- Parity Type

These are set up in mb_port.json. either construct the file manually or use Configure-a-Bird Modbus sheet to create the file contents. Then use the console to write the file. The exercise below shows the latter.

Configuration of the Modbus can be performed via the terminal. Note that the easiest method is Console with built in tool to configure the modbus.

To configure the modbus the mb_port.json and mb_dev_0X.json files are required.

Examples of json files commands to configure the modbus:

- nf:mb_port.json|{"baud":4800,"db":8,"sb":1,"prty":0,"plrt":100}
- nf:mb_dev1.json|{"addr":11,"nm":"Socomec","pts":[{"ad":50520,"rt":3,"dt":5,"sh":0,"sc":0.01},{"ad":50522,"rt":3,"dt":5,"sc":0.01},{"ad":50524,"rt":3,"dt":5,"sc":0.01},{"ad":50526,"rt":3,"dt":5,"sc":0.01},{"ad":50528,"rt":3,"dt":5,"sc":0.0001},{"ad":50530,"rt":3,"dt":5,"sc":0.0001},{"ad":50532,"rt":3,"dt":5,"sc":0.0001},{"ad":50770,"rt":3,"dt":2},{"ad":50772,"rt":3,"dt":2}]}
- reboot:1 (reboot is required after modbus settings sent to the device).